

Patent claims

1. A device with a starter-generator for internal combustion engines, the combustion engine having a centrifugal mass for stabilizing its smoothness of running, with at least one first nonpositive clutch and a flywheel generator which is actuated by means of an electrical energy source and is effectively connected with a selectable gearbox, wherein the nonpositive clutch is provided between the flywheel generator, which can be actuated by means of an electrical energy source, and the combustion engine, and wherein the flywheel generator forms the centrifugal mass of the combustion engine.

2. The device according to Claim 1, further including a further clutch provided between the flywheel generator and the selectable gearbox.

3. The device according to Claim 1 wherein a positive clutch is integrated into the selectable gearbox as an additional clutch on the input shaft.

4. The device according to Claim 1, wherein the flywheel generator is designed as a brake.

5. The device according to Claim 1, wherein the friction clutch and the flywheel generator are designed as a starter-generator subassembly, which can be inserted between the engine and the gearbox.

6. The device according to Claim 1, wherein the friction clutch, the flywheel generator and the positive clutch are designed as a starter-generator subassembly, which can be inserted between the engine and the gearbox.

7. A method for operating a device with a starter-generator for internal combustion engines, the combustion engineass for stabilizing its smoothness of running, with at least one first nonpositive clutch and a flywheel generator which is actuated by means of an electrical energy source anis effectively connected with a selectable gearbox, wherein the nonpositive clutch is provided between the flywheel generator, which can be actuated by means of an electrical energy source, and the combustion engine, and wherein the flywheel generator forms the centrifugal mass of the combustion engine, method comprising the steps of:

before the combustion engine is started, the flywheel generator is decoupled at least from the combustion engine and is separated from drag torques on the gearbox side and/or the gearbox is shifted to neutral, after which the flywheel generator is brought into effective connection with the energy source until it has reached its specified speed, and

the combustion engine is then connected up by means of the nonpositive clutch.

8. The method according to Claim 7, further comprising the step of:

after the flywheel generator has reached its specified speed, the combustion engine is first of all connected up, and the latter is started by means of the flywheel generator, after which it is briefly disconnected from the flywheel generator again, while the flywheel generator is run down until it is approximately stationary in order to connect up the gearbox, and

the combustion engine is connected up again, while the gearbox is shifted to neutral.

9. A method according to Claim 7, wherein, for the purpose of driving away, the friction clutch is opened, the gearbox input shaft is braked by the flywheel generator is closed.

10. The method according to Claim 9, wherein the flywheel generator is supplied with current after the engagement of the gear, the gearbox input shaft being adjusted to the speed of the combustion engine in such a way that the friction clutch can be closed without a speed difference.

11. The method according to Claim 7, wherein, the flywheel generator is used to synchronize the gearbox in driving mode.

12. The method according to Claim 7, wherein, in order, to change up a gear, at least one of a gearbox input shaft and the combustion engine is braked by the flywheel generator until a desired lower rotational speed of the gearbox input shaft has been reached.

13. The method according to Claim 7, wherein, in order to change down a gear, a gearbox input shaft is accelerated by at least one of the combustion engine

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and the flywheel generator until a desired higher rotational speed of the gearbox input shaft has been reached.

14. The method according to Claim 7, wherein, in order to reverse, the friction clutch is opened, the combustion engine is brought to the idling speed, the flywheel generator is driven in the opposite direction of rotation to that for forward travel and first gear is engaged.